SEPTEMBER 30, 1950
Vol. 13 No. 7

AMERICAN FERTILIZER & ALLIED CHEMICALS

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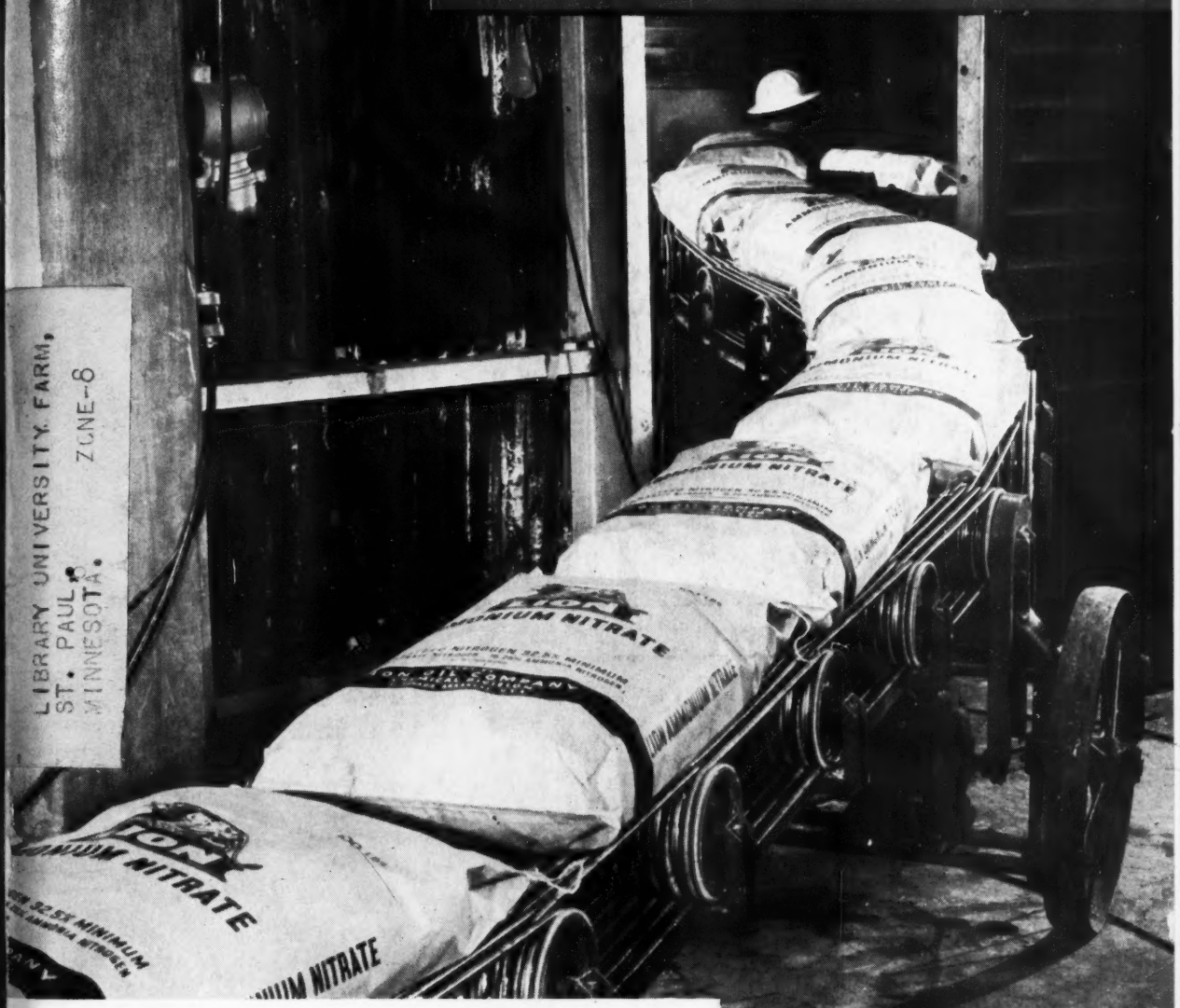

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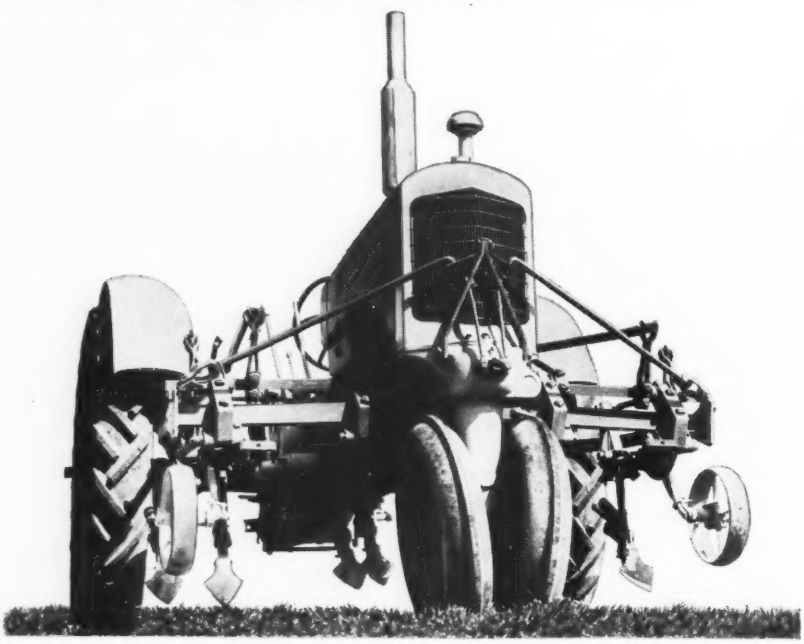

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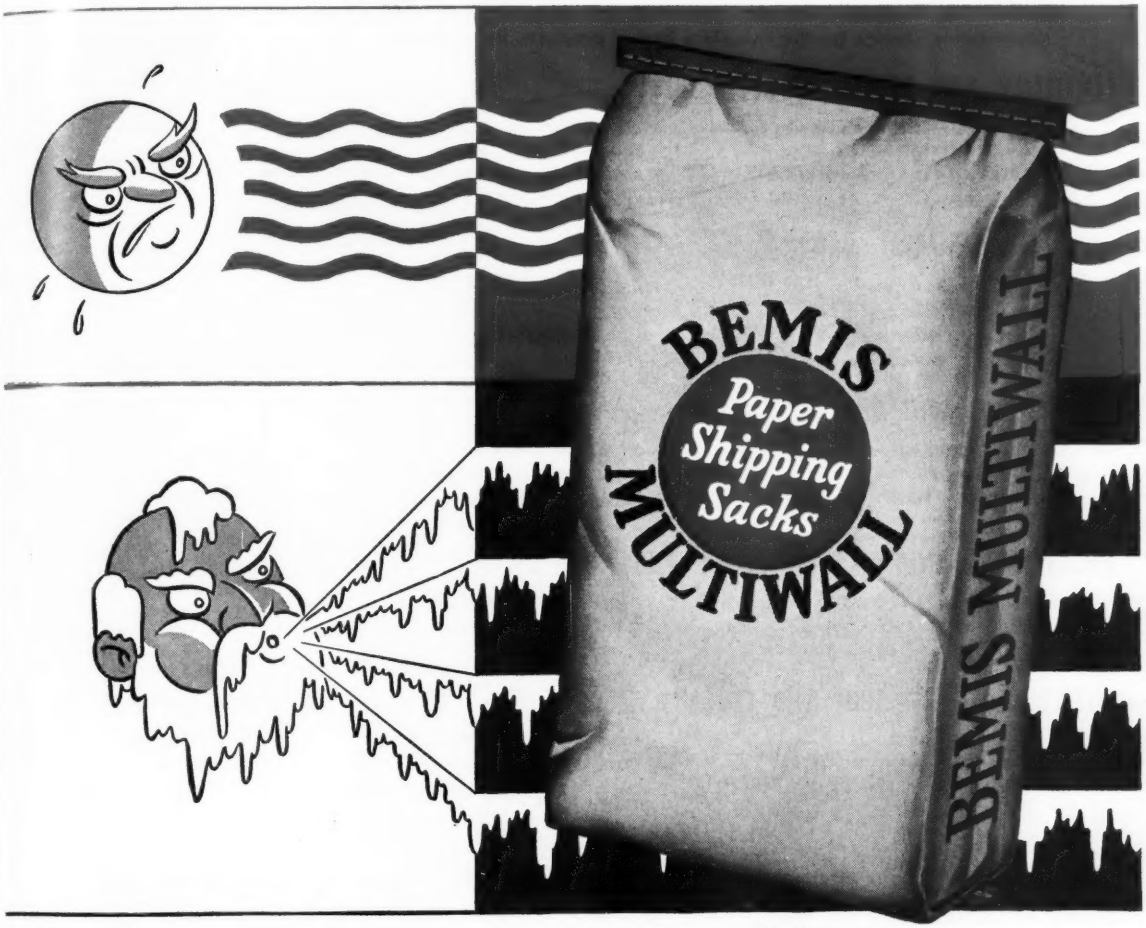

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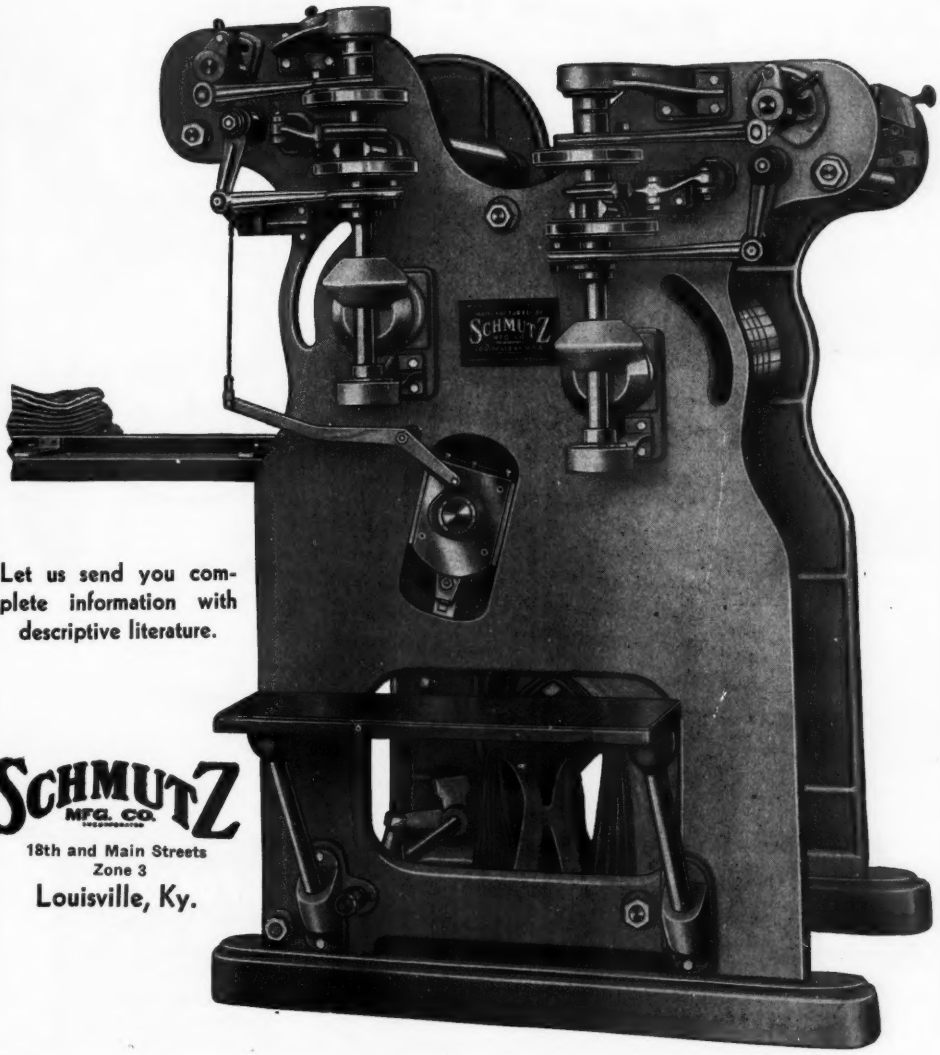

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FERTILIZER DISTRIBUTION CONTROL

THE Defense Production Act, passed by the present Congress to regulate the production and distribution of essential materials and products needed in a wartime economy, included in its provisions the distribution of commercial fertilizers. In Executive Order 10161, issued by the President on September 9th, the Secretary of Agriculture was made responsible for carrying out the provisions of the Act with respect to food, fertilizer and farm machinery.

On September 15th, Secretary of Agriculture Brannan in turn delegated to Ralph S. Trigg, Administrator of the Production and Marketing Administration, the responsibility for planning and carrying out the functions of the Act as they refer to the abovementioned products.

Commenting on the delegation of responsibilities, Secretary Brannan said, "We are fortunate in that the administrative structure needed to carry out our part of the activities under the Defense Production Act is already established in the Department of Agriculture. The Production and Marketing Administration includes practically all of the commodity and functional services which directed food and agricultural programs during World War II. All that will be needed now is a minimum of coordinating and supervisory machinery to see that our efforts are geared closely into the national defense effort.

"In delegating authority and responsibility to the Administrator of the Production and Marketing Administration and the Chief of the Forest Service, I am providing for full utilization of the facilities and services of all other agencies and offices of the Department. Our entire staff, both in Washington and in the field, will be thrown into the task of seeing that the maximum possible contribution is made to the defense effort on the food and agricultural front.

Functions and responsibilities related to "food," as defined in the Executive Order to include various agricultural commodities, include authority for allocations, priorities, requisitions, expansion of production capacity, and related functions in connection with the food aspects of the defense production program. Maintaining liaison with other government agencies and with industry, serving as claimant for materials and facilities required to insure adequate supplies of food, and appropriate responsibilities in connection with price stabilization measures are other functions delegated to the PMA Administrator.

In the field of farm equipment and fertilizer, the responsibilities are primarily those related to the most efficient domestic distribution.

The existing commodity and functional branches and offices of PMA are given the basic responsibility for developing and carrying out programs and activities related to their normal fields of operation. PMA State and County committees, Commodity offices, and other field offices will be responsible for field administration of agricultural defense activities assigned to PMA in production, storage, distribution, allocation and related fields.

Distribution Needs To

DISTRIBUTION has been a silent partner in the American enterprise system too long.

To be sure, product advertising, which is a just and vital part of distribution, has been vocal and persuasive enough.

But to paraphrase the well-known words of Priscilla to John Alden, "You have not spoken for yourself, John." Advertising has carried the torch for the product, and the maker, but about the bringers of the product there has been a pretty deep silence. The No. 1 mystery story in America is not a piece of fiction by Erle Stanley Gardner, but the true story of how the milk gets left on the porch every morning, and the corner grocer and druggist almost always have the brand of coffee and toothpaste that we prefer. Of course, we are vaguely conscious of the fact that the milkman comes and goes, and that big trucks loaded with unknown things roll our highways night and day because we occasionally get behind one on a hill. But beyond the milkman and the truck driver there is a veritable nationwide bureau of "missing" persons—good, useful, productive, hard working citizens all—and below the whirr of gears in the druggist's or grocer's cash register there is an articulated mechanism or system of almost infinite complexity and precision in which price and profit function as instruments of human freedom of choice to guide the floodtide of American production into channels where it will best serve the needs of 150 million people. But of all that the average citizen knows virtually nothing and few of us know enough.

We need to point out and direct widespread earnest attention to: (1) the vital public relations role of distributors in representing and explaining the operations of business to their 100 million customers and 15 million employees; (2) the numerous services performed by distributors at increasingly lower costs; and (3) the importance of distribution to business stability and high employment.

Industry Waking Up

Industry, somewhat belatedly perhaps, has awakened to the realization that it is necessary to sell its philosophy as well as its products. But distribution, which has done a fairly good job of selling and servicing industry's products, has done very little to sell itself. It simply has not, as I said a moment ago, spoken for itself. In 1947, a survey of the material that business was sending to teachers revealed that most of it had to do with technology. Companies told about the origin and processing of goods, the mechanical characteristics of machines, the physics and chemistry of their products. They told very little about how business organizes people into production units, how it attracts capital, how it meets competition, and so on.

In an exploratory discussion such as this, I think it is probably good to begin by trying to define our problem before we proceed to techniques. I think it is a fair statement to say that your public relations problem, as distributors, is tougher than mine, as one who is entrusted with that responsibility for General Electric. I think you are also in a better position to carry it out than I. I will try to explain both of these points as we go along.

Industry has been under sharp attack from many sides in recent decades. Frequently the grounds for these attacks have shifted with kaleidoscopic suddenness. The public or segments of it, have been alternately critical of our prices, our profits, wages, labor policies and practices.

In 1945, a majority believed that industry was making too much profit. There was a great public ignorance about the amount of profits, estimates ran several hundred per cent above the actual figures, and very few were conscious of the fact that war profits had to be renegotiated.

In 1946, we were under fire on the issue of wages. Then, 64 per cent of workers believed that companies paid out more to stockholders and to management than to workers.

In 1947, it was prices. In this instance, the public was not generally aware of the efforts being made by manufacturers to hold down prices in the face of rising material and labor costs.

And so on, but these are enough examples to illustrate my point. You will observe that in each of the above instances the public was largely assuming something that was far from, or opposite to, the truth, and the public relations problem was basically to get the correct information to them.

Public After Distributors

But even more important, while we were under attack on these various issues, there was general agreement among a large majority of the public that industry was doing a pretty good job of production and filling the wants of the nation in war and peace. There was no time at which they said that the producer *ought to be put out of business.*

They sure do about the distributor!

Speak Up . . .

Improved public relations are needed to sell distribution as an important part of our economy

By R. S. Peare*
Vice-President, General Electric

When I was a boy back in Indiana, the countryside was echoing to the war cry of a group that, I believe, called themselves the Nonpartisan League. Their war cry was, "eliminate the middleman."

Well, the co-operatives didn't eliminate him.

And, the chain stores didn't eliminate him.

Which in itself may be an indication that he performs a fairly indispensable function in our economy.

But there are plenty of people still trying, and thinking that way.

Distributors are employers

Just the other day I got a letter from an engineer in our own company. It was a blast at the cost of distribution—he didn't see any use for advertising, or any use for distributors. Written between the lines was the statement that he, as a maker, or at least a designer of things, was a useful, necessary productive member of society, but that the distributor, who doesn't make anything, but just brings things to where they will be useful to people, is a useless, non-essential, non-productive one. And an awful lot of good, intelligent, hard-working, productive members of our society share his viewpoint, or blind spot.

At the same time I haven't found nearly enough places where the distributor, along with selling the product, has also been selling the fact that he is an independent business man, handling the products of private enterprise, at lower and lower costs and with greater service, and sometimes at a dangerously low profit margin.

Also, I haven't seen any place where distributors have taken the trouble to point out that existence of the big plants of their principals in cities hundreds of miles away have given employment to their (the distributors') people.

I don't know why he has hesitated so long to speak up in his self-defense, unless he has been too modest, unless he has underestimated the services he performs or the influence he has. Perhaps he has jumped too quickly to the assumption that he doesn't have the time or money to plead his cause before the public—but he has found money for other essentials to his business, such as product advertising.

Perhaps he has forgotten the fact that the manufacturer recognized long ago, that the distributor carries more weight with his neighbors than a stranger many miles away could ever carry.

Or perhaps he has just underestimated the market that exists for this kind of material and information. During the past several years such firms as the Psychological Corporation and the Opinion Research Corporation have been making surveys of the attitudes of people to business. This literature forms some of the most valuable and instructive reading that any businessman can do.

Schools can help

Two-thirds of the social science teachers say associations and business firms ought to make more of an effort to explain the operations and problems of business.

A majority of newspaper men say that unions do a better job of giving out information than companies.

Three out of four clergymen say they want more help in understanding business problems and what companies are doing to meet them.

You who are concerned with distribution know, of course, what the costs of distribution are. You know what proportion of those costs are made up of services and privileges which the public would surrender only over its dead collective body: product-at-point-of-sales shopping selectivity, credit, delivery, the return-of-goods privilege, quick reliable service. You know these things, but large and important segments of our population don't.

(Continued on page 28)

*Based on a talk delivered at the National Marketing Conference.

Convention Program of California Fertilizer Ass'n.

President J. M. Quinn has announced that the 27th Annual Convention of the California Fertilizer Association to be held at Hotel del Coronado in San Diego, November 2, 3, and 4th, will feature outstanding men in the field of science including Dr. Russell Coleman, Dr. Vincent Sauchelli, Dr. Paul F. Sharp, and others.

Two days will be given over to convention business, the third day to recreation and sports.

Spotlighting the opening day are Dr. Paul F. Sharp, Director of Experiment Station, College of Agriculture, University of California. His topic will be "Research Program of the College of Agriculture."

The second speaker of the morning, Dr. Vincent Sauchelli, Director of Agricultural Research, Davison Chemical Corporation, Baltimore, will discuss "Phosphates in Agriculture."

Dr. Russell Coleman, President of the National Fertilizer Association will be the luncheon speaker.

The afternoon meeting has been set aside for official Association business.

Allen B. Lemmon, Chief of the Bureau of Chemistry, mapped the session for Friday morning, November 3rd, and with Robert Z. Rollins, Assistant Chief, will present a "Report of the Year."

They will be followed by DeWitt Bishop, District Inspector, Bureau of Chemistry, Sacramento, "Deficient Fertilizers, the Child of Errors."

Dr. W. E. Domingo, Director of Agronomy, The Baker Castor Oil Company, closes the meeting with a talk and motion picture on "Castor Beans, America's New Cash Crop."

The College of Agriculture, University of California and the Soil Improvement Council of CFA are jointly handling the afternoon session. M. E. McCollam, Chairman of the Soil Improvement Committee, will open the proceedings and introduce:

Dr. Daniel G. Aldrich, Associate Chemist Citrus Experiment Station, Riverside,—"P and K Experiments on Citrus."

J. H. Nelson Laboratories, Stockton, "Observations on Fertilizer Use in the Stockton area."

Dr. Hans Jenny, Professor of Soils, College of Agriculture, Berkeley,—"The Contact Theory of Mineral Nutrition of Plants in Soils."

Mr. A. H. Dill, A. B. Farquhar Company, "Precision Placement Machinery."

Dr. A. O. Lorenze, Assistant Professor Truck Crops, College of Agriculture, Davis, "Fertilizers in Irrigation Water."

The Association banquet will be held on Friday evening.

A golf contest for women, and golf and bowling contests for men take place on Saturday morning, with prizes awarded at a wind-up luncheon in the afternoon.

Balfour Guthrie Company and American Potash and Chemical Company will be hosts at cocktail parties, long a convention custom, on Thursday and Friday evenings.

The Board of Directors will hold their regular business meeting on Wednesday evening, November 1st.

Dr. Wallace Macfarlane, Pacific Guano Company is Program Chairman.

Tom Lathe, local manager of Wilson and George Meyer Company is Entertainment Chairman.

Mrs. Norman Springer is Chairman of the Ladies Convention Committee which includes Mrs. Byron Reynolds, Mrs. Ned Lewis, and Mrs. Sidney Herzberg.

Officers and Directors will be elected for 1951. Outgoing officers are President J. M. Quinn, Vice-President Lowell Berry, Treasurer Grover Dunford, and Secretary Paul Pauly.

Directors whose three-year terms expire are Lowell Berry, Best Fertilizers Company; Murray C. McNeil, Swift and Company; and Byron Reynolds, Bandini Fertilizer Company.

Elmer S. Nelson, Executive Secretary and Manager, has charge of general arrangements.

Chorlton to Manage Ore.-Wash. Portland Plant

Mac C. Taylor, president of the Oregon-Washington Fertilizer Co., Seattle, Wash., has announced that on September 25th, William R. Chorlton was appointed manager of their plant at Portland, Ore.

Mr. Chorlton graduated from the State College of Washington in 1938, and worked with the Washington State Department of Agriculture until 1943. His war service from 1943 to 1946 was with the Marine Corps, following which he joined the Simplot Fertilizer Co. organization as representative for Washington.

The business of the Portland plant, which was built in the summer of 1948, has increased so rapidly that the appointment of a full-time manager was found necessary in order to give satisfactory service to the company's Oregon dealers.

Leases Asked For Wyoming Phosphate Land

More than 2400 acres of land in Lincoln County, Wyoming, is being offered for phosphate leasing through competitive bidding by the Bureau of Land Management, U. S. Department of the Interior.

The sale will be held in the office of the Director, Bureau of Land Management, Washington 25, D. C., at 1 p. m., EST, November 1. The minimum bid is $1 an acre with leases to be issued to qualified bidders of the highest cast amount an acre as a bonus for the privilege of leasing under the phosphate provisions of the mineral leasing act.

A description of the land to be leased and details of the terms and conditions of the sale can be obtained from the Director.

Sealed bids marked "phosphate lease" should be mailed on or before 1 p. m., EST, November 1 to the Director, Bureau of Land Management, Washington 25, D. C. Each bidder must submit with his bid one-fifth of the amount bid by him in cash or by certified check or money order made payable to the Treasurer of the United States and file qualifications to receive a lease.

A. C. S. FERTILIZER ABSTRACTS

Part II of the Abstracts of the papers presented at the annual meeting of the Division of Fertilizer Chemistry, American Chemical Society, held in Chicago, September 4, 5 and 6. Abstracts of the remaining papers were included in our September 2, 1950, issue.

Fertilizer by Hydrolysis and Ammoniation of Cellulosic Materials

G. L. Bridger and J. W. Anderson, Department of Chemical and Mining Engineering, Iowa State College, Ames, Iowa

Studies were made on the ammoniation of cellulosic waste materials to produce nitrogenous fertilizers. Two general methods were used.

One method was based on hydrolysis of the hemicelluloses in these materials with dilute solutions of mineral acids of salts followed by ammoniation with anhydrous ammonia of the hydrolysate. With corncobs, when 8.25 per cent sulfuric acid and a liquid/solid ratio of 2.0 was used for hydrolysis, and ammoniation was carried out slightly above room temperature, a product was obtained containing 7.4 per cent nitrogen of which 42 per cent was organic (Product A). With the same hydrolysis conditions and an ammoniation temperature of 249° C., a product was obtained containing 9.5 per cent nitrogen of which 56 per cent was organic (Product B). In product A, 86 per cent of the total nitrogen was water soluble, and in product B only 18 per cent was water soluble. Normal and concentrated superphosphates or dilute phosphoric acid in the hydrolysis step did not result in as much organic nitrogen as did sulfuric acid.

The second method involved the direct ammoniation of the cellulosic materials with anhydrous ammonia. By this method, a product containing 4.6 per cent nitrogen was obtained with corncobs at a temperature of 300° C. (Product C). In this product, all the nitrogen was organic and none of it was water soluble.

Preliminary greenhouse tests of the three products were made in comparison with ammonium sulfate and milorganite as controls. Product A showed slightly better plant response than milorganite but somewhat less response than ammonium sulfate. Products B and C showed some response but were inferior to both controls.

The Role of Gypsum in the Reclamation and Improvement of Alkali Soils for Agricultural Purposes

Omer J. Kelley, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. D. A., Industrial Research Bldg., Colorado A. and M. College, Fort Collins, Colo.

Alkali soils have considerable economic importance in the irrigated region in the Western United States. They are usually associated with poor drainage conditions either of a temporary or permanent nature.

Alkali soils are those soils which contain sufficiently high exchangeable sodium to impair their productivity. For a purpose of definition soils having exchangeable sodium percentage above 15 are considered alkali soils. There are two types of alkali soils namely the saline and non-saline alkali soils. The saline alkali soils seldom have a pH higher than 8.5 and the colloids usually remain floculated. If the excess salts of these are removed by leaching the properties then may change and then become similar to those of non-saline alkali soils. The non-saline alkali soils usually are characterized by having a high pH between 8.5 and 10. These soils are in a dispersed condition and quite impermeable to water. These soils become quite sticky when wet and hard when dry. It is difficult to work them into a good seed bed.

In the case of Alkali soils it is necessary to add some chemical amendment to replace exchangeable sodium in reclamation if gypsum isn't in the soil. Gypsum and sulfur are the amendments used most frequently. Gypsum is considered a faster acting amendment than sulfur.

Good drainage is essential to the reclamation of alkali soil.

The replacement of sodium with calcium and the removal of the exchangeable sodium does not always assure reclamation. In some cases stable aggregation is obtained only after dehydration through evaporation, freezing and thawing or by plant growth.

Other good soil management practices are essential in reclamation of alkali soils and the restoration of crop productivity.

The Influence of Silicate Ions on Potassium Fixation by Clay Minerals

M. M. Mortland and J. E. Gieseking, Department of Agronomy, University of Illinois, Urbanna, Ill.

Preliminary X-ray diffraction studies on montmorillonitic minerals dried with potassium silicate indicated that the crystal structure of the montmorillonitic minerals was changed to a mica-like structure. These studies suggested the need for information concerning the amount of potassium that might be fixed by the various clay minerals when dried with potassium silicate and also the need for information concerning the tenacity with which any fixed potassium might be held.

Kaolinitic, montmorillonitic, and illitic minerals from soil clays and geological deposits were dried at 110° C. with potassium silicate and with potassium hydroxide in two separate series. The samples were boiled with normal nitric acid and washed twice with this same reagent. The difference between the amount of potassium added in the potassium silicate and potassium hydroxide and the amount recovered in the boiling nitric acid was considered fixed potassium.

The illitic clays fixed large amounts of potassium, the kaolinitic minerals fixed little or no potassium, and the montmorillonitic minerals fixed intermediate amounts of potassium when dried with potassium silicate. Little or no potassium was fixed by these minerals when they were dried with potassium hydroxide. The results indicate that the silicate ion promotes the tenacious fixation of potassium by illitic and montmorillonitic minerals.

Phosphate Fertilizer by the Fusion of Phosphate Rock and Olivine

R. W. Moulton, G. S. Greaves, and P. G. Hebner, Department of Chemistry and Chemical Engineering, University of Washington, Seattle, Washington

The production of a phosphate fertilizer by the electric furnace fusion of phosphate rock and olivine has been studied on both laboratory and pilot plant scale equipment. The results of the pilot plant study indicated the desirability of commercial manufacture of this new phosphate fertilizer. This product has now been on the market for about two years.

The results of the laboratory work showed the influence of temperature, time, composition of raw materials, and other operating variables on product quality. The results of the pilot plant study gave information as to the best materials of construction and also the probable power and electrode consumption. The commercial operation has verified the predictions of the pilot plant study and given more accurate data as to the costs of operation.

This product is different from other phosphate fertilizers. It is of about the same phosphate content as superphosphate. It is gray, granular, dense, odorless, and free flowing. The product contains soluble magnesium in amount of about fourteen per cent. This is a desirable feature for soils having a magnesium deficiency. The product also has a soil-sweetening value equivalent to 1,200 pounds of limestone per ton. It is finding ready acceptance by the farmers in the Pacific northwest.

Gypsum as a Soil Conditioner in Humid Regions

J. C. Rinehart, J. C. F. Tedrow, and F. E. Bear, Soils Department, New Jersey Agricultural Experiment Station, New Brunswick, New Jersey

In arid regions, gypsum is used to replace sodium in soils. In humid areas, where sodium has been leached out by heavy rains, it is used in improving drainige of wet soils. Its use for the latter purpose is not new, but no very reliable evidence is at hand on how to use t to best advantage. The New Jersey Agricultural Experiment Station applied gypsum to a large number of wet soils. In some cases, drainage was improved, in others not. Nature of the soil profile is highly important in determining effectiveness. On soils slowly permeable to water in upper horizons but with good under-drainage, results are good. Studies include length of time of effectiveness, amount required, usefulness in improving tilth, extent to which its Ca replaces H ions, and best time and method for its application. Available data are shown.

Acidulation Characteristics of Certain Western Phosphate Rocks

G. L. Bridger and Elmer H. Brunsting, Department of Chemical and Mining Engineering, Iowa State College, Ames, Iowa

Three Idaho phosphate rocks containing 31.6, 31.2, and 29.7 per cent P_2O_5 were acidulated with both sulfuric and phosphoric acids over a wide range. The compositions and caking tendencies of the resulting normal and concentrated superphosphates were determined. The setting-up characteristics of the reacting mixtures were studied to give an indication of the suitability of the rocks for use in a funnel-type continuous mixer. For comparison, a Florida phosphate rock containing 32.5 per cent P_2O_5 was also studied.

For a given degree of conversion of the P_2O_5 in the rocks to an available form, the acid consumption increased with decreasing P_2O_5 content of the rocks; the Idaho rocks respectively required 4, 10, and 16 per cent more sulfuric acid and 4, 7, and 17 per cent more phosphoric acid to achieve 95 per cent conversion than the Florida rock.

In the acid-rock reaction, the fluid times for all of the rocks with both acids were sufficiently long to indicate that they could be successfully acidulated in the funnel-type continuous mixer. The time for solidification of the concentrated superphosphates made from all of the rocks was short enough to indicate the material could be conveyed to curing directly; however, for the normal superphosphates, this time was so long that use of a den before curing would probably be necessary.

The superphosphates made from the Idaho rocks showed no more tendency to cake on storage than did those made from the Florida rock.

Calcium Sulphate as A Fertilizer for Peanut

W. E. Colwell, Professor of Agronomy, North Carolina State College, Raleigh, N. C.

The calcium requirements of the peanut plant have been recognized for at least 65 years. It was pointed out in 1885 that a soil must contain a "goodly percentage" of lime to produce a "paying crop of pods." In the peanut producing areas of North Carolina and Virginia where the large seeded types are grown, it is a common practice to add limestone and gypsum.

Recent studies reported in this paper deal with several aspects of the problem of supplying calcium to peanuts, by and large through calcium sulphate.

It is found that no other ion tested, either anion or cation, exerts

(Continued on page 28)

Granule Size vs. Crop Response

Second part of a series on crop experiments abroad. This deals with experiments in Sweden and Russia. The first part was on Germany: (*See issue of September 16*)

By Vincent Sauchelli
Director of Agricultural Research,
Dawson Chemical Corp,, Baltimore, Md,

Experiments in Sweden

Olle Franck, Bureau of Soil Research, at Stockholm, Sweden, conducted large scale investigations during 1939–1943 to determine the advantages of granulated over powdered superphosphate. His results can be summarized in Table VII. These data were presented before The Fertilizer Society, London, October 10, 1947, by Sven Nordengren. Crops grown were Seger oats and Golden barley.

Experimental Evidence from Russia

The influence of granulation on the uptake of phosphorus by plants has been investigated in Russia and the results were published in 1949.[1] The authors state: "Our own tests covering a period of seven years and the tests of other scientific research organizations have shown that the effectiveness of superphosphate is increased by granulation, both when introduced in drills and when broadcast. With broadcasting, granulated superphosphate increased the yield by 40 to 50 per cent over that produced by the same amount of powdered superphosphate. The effect was even greater when granulated superphosphate was introduced in drills. On the average one kilogram of drilled granulated superphosphate increased the yield 5- to 6-fold over that obtained by broadcast powdered superphosphate. The utilization of the phosphoric acid likewise increased markedly.

"The test plants included millet, table beets, rape, turnips, and radishes. The soil was a clay podzol type near Moscow, having a pH 6.0 and a P_2O_5 content of 20 mg. per 100 gms. (Truog method.) The grain, roots, leaves, and straw were analyzed, the roots being analyzed twice, before maturing and after harvesting.

"The utilization of phosphoric acid in the superphosphate was studied as a function of granulation, the method of introduction, the amount of fertilizer, and other factors. In all the experiments comparison was made between granulated and powdered superphosphates. The granulated superphosphate was prepared by addition of millet husks. The grain size varied between 1 and 3 mm.

"A great difference was observed in the utilization of phosphoric acid. The drilled granulated superphosphate (8 ig. P_2O_5/ha.) caused table beets to utilize an additional 7.52 kg. of P_2O_5 per hectare (as compared with the control) while the broadcast superphosphate (120 kg. P_2O_5/ha.) produced an additional utilization of 9.88 kg. of P_2O_5 per hectare. Analogous values were obtained in the tests with rape.

"So far as is known to the authors, such a high utilization of phosphoric acid upon drilling of granulated superphosphate has not been mentioned in the literature.

"This very high assimilation of phosphoric acid by the plants is explained by the simultaneous action of two factors, granulation of superphosphate and drilling. Localized introduction of superphosphate and

[1] N. S. Avdonin & L. A. Tertychnaya Soviet Agron. 7, No. 10, 60–8, (1949).

TABLE VII. POWDERED VERSUS GRANULATED SUPERPHOSPHATE

Pounds per acre — *Years and yields in lbs. per acre*	*1939*	*1940*	*1941*	*1942*	*1943*	*Avg. 5 years*
No superphosphate, total yield	1898	1944	1584	2615	2420	2052
Extra yield with 36 lbs. P_2O_5:						
1. As pulverized super *broadcast*	+200	+112	+ 22	+164	+125	+130
2. As granulated super *broadcast*	+266	+113	+ 88	+215	+340	+194
3. As granulated super *drilled in*	+307	+255	+223	+306	+393	+301

TABLE VIII. UTILIZATION OF P_2O_5 FROM GRANULATED SUPERPHOSPHATE

Plant	*Yield increase from drilling, cwt./ha.*	*P_2O_5 utilized by plants, kg./ha.* — *Without drilling*	*Drilling of superphosphate*	*Sorption due to drilling*	*"Coeff. of utilization," %*
Millet	7.9	13.77	22.28	8.51	106
Rape (1st test)	29.6	25.40	32.60	7.20	90
Rape (2nd test)	43.7	30.30	39.97	9.67	121
Rape (3rd test)	41.7	17.64	28.30	10.66	133
Turnips	32.4	37.43	61.14	23.71	296
Radishes	75.0	43.21	73.27	30.06	375

drilling, in particular, have an exceptionally great effect on the utilization of phosphoric acid. Many tests were carried out in connection with this problem. The results of six tests made on podzol argillaceous soil near Moscow in 1947–1948 are listed in Table VIII.

Granulated Superior

"In all the tests granulated superphosphate was drilled together with the seeds on the basis of 8 kg. of P_2O_5 per hectare. It is evident from Table VIII that this small amount of granulated superphosphate, when drilled, increased markedly the plant yield. For example, 8 kg. of P_2O_5 per hectare increased the yield of millet grain by 7.9 cwt./ha. One kg. of P_2O_5 increased the yield of millet by 99 kg. Numerous tests of scientific research organizations showed that broadcast powdered superphosphate increased the yield for cereals, referred to 1 kg. of phosphoric acid introduced, by 2 to 8 kg.

"Very large absolute increases were obtained also for roots with drilled granulated superphosphate. Application of 8 kg. of P_2O_5 per hectare increased the yield of radishes, for example, by 75 cwt./ha. Simultaneously the utilization of phosphoric acid also increased.

Better Assimilation

"The last column in Table VIII gives the amount of P_2O_5 assimilated by the plants because of the drilling of granulated superphosphate. It is evident from the data in this column that under the action of 8 kg. of P_2O_5 per hectare, introduced as granulated superphosphate in drills, the plants assimilated an additional 7.20 to 30 kg. of P_2O_5 per hectare. For example, millet utilized an additional 8.51 kg/; rape (3rd test), 10.66 kg/; and turnips, 23.71 kg. The effect on radishes was even greater; 8 kg. of phosphoric acid introduced for this plant enabled it to assimilate an additional 30 kg. of P_2O_5.

"Accordingly, if the coefficient of utilization is calculated by the method used customarily by agrochemists, for radishes the coefficient of phosphoric acid in superphosphate, when drilled in a granulated form, is 375 per cent.

"Two conclusions may be drawn from the values cited: (1) drilling of granulated superphosphate increases markedly the utilization of P_2O_5 from the fertilizer to an unprecedented value and (2) the methods used in agrochemistry for calculating the coefficient of utilization of fertilizers by difference between the yields from control plots and fertilized plots are both conditional and entirely incorrect. In the tests discussed above it is out of the question to speak of a 'coefficient of utilization' of phosphoric acid in superphosphate when the plants actually utilized more P_2O_5 than the amount introduced with the fertilizer. It is obvious that in the tests the plants made good utilization of phosphorus from both the superphosphate and the soil.

"This fact is of great importance to the theory and practice concerning the use of fertilizers. It is clear that, with skillful application of superphosphate, it is possible by introducing 1 kg. of nutrients with the fertilizer to assure the assimilation by the plants of two and more kg. of these nutrients.

New Theory

"According to the old agrochemical theories that derived from the mechanistic concept of Liebig, fertilizers were assumed to be media for the direct supply of nutrients to plants. The coefficients of utilization were calculated on this basis by assuming that the difference in the uptake of nutrients by plants in fertilized and control plots was obtained as the result of direct utilization of the nutrients from the fertilizers introduced.

"The data in Table VIII show that this does not apply. The tests described above proved that, under the action of the fertilizers introduced, plants may utilize a larger amount of nutrient than that present in these fertilizers. It is obvious that plants which, under the action of granulated superphosphate, gave a yield of roots higher by 40 to 75 cwt./ha. utilized much more fully the nitrogen and other nutrients in the soil. For example, in the test with millet (8 kg. P_2O_5/ha.) the plants not only utilized more phosphoric acid than the amount introduced with the granulated superphosphate, but also took up 40 per cent more nitrogen than did the plants on the plots without phosphorus fertilizers.

"Hence, although phosphorus alone is introduced, the plants assimilate better the nitrogen and other nutrients. How is it possible to refer to a coefficient of utilization of nitrogen when although nitrogen was not introduced its utilization increased (by 40 per cent in the present case)?

Complex Action

"The data obtained show that fertilizers cannot be considered media for the direct supply of nutrients to plants. The action of fertilizers is much more complex: fertilizers are not only sources of direct supply of nutrients to plants; they also affect the microbiological processes in the soil, the soil reactions, and the physical properties of the soil. This action of fertilizers is not the result of a direct effect upon the soil but through the medium of the microflora and the plants which they are intended to fertilize.

"It is now established that phosphorus and organic compounds rich in carbon increase the activity of nitrogen bacteria (Fedorov, *1948*).

"Accordingly, the introduction of phosphorus improves the supply of nitrogen to the plants by assimilation from both the soil and the air. Analogous phenomena are observed upon introduction of phosphorus and potassium for legumes which utilize better the atmospheric nitrogen (through tuberous bacteria), develop more markedly the root system, improve the structure of the soil, and enrich it with organic compounds.

"The tests showed furthermore that under the action of a small amount of drilled granulated superphosphate the root system branches markedly, becomes covered with a larger number of hair roots, and penetrates much deeper into the soil. As a result the plants utilize much better the moisture and the nutrients from deeper layers of the soil, which are inaccessible to them

(*Continued on page 26*)

Fertilizer Companies To Distribute TVA Products

As a further step in its efforts to cheapen the cost of fertilizer to the farmer and to promote better use of fertilizers, TVA has joined in an experimental undertaking with certain segments of the private fertilizer industry. Fertilizers manufactured by TVA at its experimental plants at Wilson Dam, Alabama, are being, or soon will be, distributed to farmers through a few private companies from which TVA will secure information on distribution costs and practices to supplement that presently being obtained from farmer cooperatives.

Six companies have been selected to carry out the experiment during the present fiscal year. They are: Summers Fertilizer Company, Baltimore, Maryland; Sylacauga Fertilizer Company, Inc., Sylacauga, Alabama; Epting Distributing Company, Leesville, South Carolina; Knoxville Fertilizer Company, Knoxville, Tennessee; Capital Fertilizer Company, Montgomery, Alabama; Pocahontas Fertilizer Company, Pocahontas, Iowa.

These companies were selected from a number of applicants on the basis of certain criteria including ability and willingness to promote TVA objectives with respect to use of its fertilizers, geographic area served, type of organization and method of distribution.

TVA experimentally manufactures highly concentrated phosphate and nitrogen fertilizers. Under the contracts entered into between TVA and the companies, the companies purchase the fertilizers from TVA and retail them to farmers or sell them to their established dealers who in turn sell to farmers.

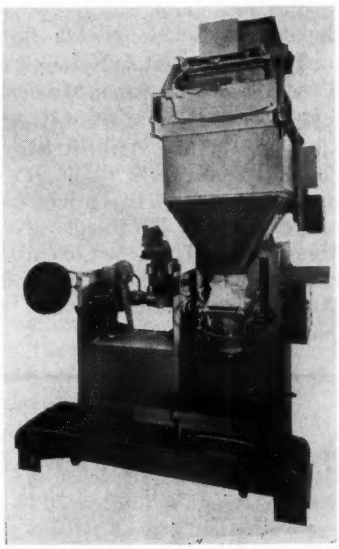
Contracts between TVA and the companies are generally similar to those now in effect between TVA and cooperatives distributing TVA fertilizers. The distributors agree to keep a supply of the fertilizers for sale unmixed with other materials and to use the remaining fertilizers only in high-analysis mixtures. They also agree to furnish TVA with records of the costs of handling and distributing both TVA materials and comparable materials obtained from other sources.

The companies agree to cooperate closely with the agricultural colleges of the states in which they operate and to assign qualified personnel to help their farmer customers carry out the recommendations of the colleges with respect to sound use of these fertilizers. Plans for conducting these educational activities must be submitted to TVA before the distributor receives fertilizers for the coming season, and reports on activities are required at the close of the year.

Fertilizers being used in the distribution experiment include concentrated superphosphate, which contains 45 to 50 per cent P_2O_5 in contrast to the 16 to 20 per cent P_2O_5 contained in ordinary superphosphate, and ammonium nitrate, which contains 33 per cent nitrogen, or 1½ to 2 times the amount contained in the less concentrated solid nitrogen fertilizers. In some sections of the country, calcium metaphosphate also will be distributed. This material contains 60 to 62 per cent available P_2O_5. Because of its high concentration and comparatively high production cost, it is particularly adapted, from an economic standpoint, to areas where fertilizers must be shipped in from great distances.

Bemis Announces New Gravity Packer

A new Bemis Gravity Packer for packing free flowing commodities in either cotton or paper bags has been developed by the Bemis Bro. Bag Co. Packaging Service. This new machine is a combined filling, weighing, and bag closing unit, so designed that it can be operated with either a one-man or two-man crew.



Bemis Gravity Packer

The Bemis Gravity Packer will accurately pre-weigh and pack such items as fertilizer sugar, salt and similar free flowing products, with a weight range of 50 to 140 pounds. The unit consists essentially of a net weighing scale, a pneumatically operated oscillating mechanism which settles the contents of the bag, a dual bag closing unit which will sew either multiwall open-mouth paper or textile bags, and a conveyer. This conveyor is composed of four "V" belts concavely arranged so the filled bags will stand upright unassisted as they pass from the packing spout to the sewing head for closing.

The dual bag closing unit consists of one sewing head for textile and one for paper bags, the head that is not in use being swung up out of the way of the bags passing along the conveyor. A changeover from packing one type of bag to another is accomplished simply by swinging the proper sewing head in place.

The several installations of the Bemis Gravity Packer made to date give accurate performance data on this unit. Records show that one man can pack from five to seven bags per minute, and up to twelve bags per minute can be packed with a two-man crew. Weights are accurate within a 2-ounce tolerance or less.

Fertilizer Control Officials To Hold Annual Meeting In Washington

The fourth annual convention of the Association of American Fertilizer Control Officials will be held at the Shoreham Hotel, Washington, D. C., on Friday, October 6th. Morning and afternoon sessions will start at 9:30 and 2:15 respectively.

At the morning session, the opening address by Association President John B. Smith will be followed by talks by Clifton A. Woodrum, president of the American Plant Food Council, and by Russell Coleman, president of the National Fertilizer Association. Other subjects to be considered are as follows:

"Comparative Effects of Organic and Inorganic Fertilizers on Nutritional Quality of Crops" by Kenneth C. Beeson, Cornell University.

"Composition of Mixed Fertilizers in Relation to Guarantees" by Walter Scholl and H. M. Wallace, U. S. D. A.

"Developing a Pasture Program in Virginia" by H. L. Dunton, Virginia Polytechnic Institute.

"History and Present Status of the Magruder Sample" by S. F. Thornton, F. S. Royster Guano Co.

"The Reporting System vs. Tax Tags" by L. C. Jacobs, supervisor, Feeds, Seeds and Fertilizers, Nashville, Tenn.

The program for the afternoon session will feature a talk on "Insecticides in Fertilizers" by M. D. Farrar, Clemson A. & M. College. Reports will also be made on the following investigations being carried on by the Association:

"General Terms" by J. L. St. John, Pullman, Wash.

"Nitrogen Products (Organic)" by M. P. Etheredge, State College, Miss.

"Nitrogen Products (Inorganic)" by J. W. Kuzmeski, Amherst, Mass.

"Phosphorus" by J. F. Fudge, College Station, Tex.

"Potash" by R. W. Ludwick, State College, N. Mex.

"Calcium and Magnesium" by W. B. Griem, Madison, Wis.

"Manganese" by J. B. Smith, Kingston, R. I.

"Boron" by R. C. Berry, Richmond, Va.

"Zinc and Copper" by Gordon Hart, Tallahassee, Fla.

"Mixing and Segregation" by E. W. Constable, Raleigh, N. C.

"Registration Forms" by Paul Ijams, Topeka, Kan.

"Publications" by Bruce Poundstone, Lexington, Ky.

"Specimen Labels" by E. A. Epps, Jr., Baton Rouge, La.

"Tonnage Reporting System" by R. A. Maddox, Jackson, Miss.

H. A. Halvorson, St. Paul, Minn., will report for the States Relations Committee, J. L. St. John, Pullman, Wash., for the Executive Committee, and S. B. Randle, New Brunswick, N. J. for the Committee on the Model State Fertilizer Bill. The meeting will close with the election of officers.

The fertilizer control officials will be entertained on Thursday evening, October 5th, at the annual dinner of the Chemical Control Committee of the National Fertilizer Association. On Friday evening, October 6th, the American Plant Food Council will be hosts at a dinner in their honor.

Fertilizer Division, A. C. S. Elects Officers

At the recent meeting of the Division of Fertilizer Chemistry, American Chemical Society, held in Chicago, the following officers were elected to conduct the affairs of the Division for the year 1951:

Chairman — Vincent Sauchelli, Davison Chemical Corporation, Baltimore, Md.

Secretary—S. F. Thornton, F. S. Royster Guano Company, Norfolk, Va.

Executive Committee—Stacy B. Randle, New Jersey Agricultural Experiment Station, New Brunswick, N. J.; C. A. Butt, International Minerals & Chemical Corporation, East Point, Ga.; J. D. Romaine, The American Potash Institute, Washington, D. C.; H. B. Siems, Swift & Company, Plant Food Division, Chicago, Ill.

Councilors — James A. Naftel, Pacific Coast Borax Co., Auburn, Ala.; W. H. McIntire, Tennessee University Agricultural Experiment Station, Knoxville, Tenn.

Alternate Councilors—H. P. Cooper, Clemson Agricultural College, Clemson, S. C.; K. G. Clark, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. D. A., Beltsville, Md.

BONE MEAL TANKAGE BLOOD
SHEEP—COW—POULTRY MANURE
CASTOR POMACE NITROGENOUS
GROUND TOBACCO STEMS HOOF MEAL
ALL FERTILIZER MATERIALS
FRANK R. JACKLE
405 Lexington Avenue New York 17, N. Y.

FERTILIZER MATERIALS MARKET

NEW YORK

Little Change in Market Reported. Heavy Demand for Triple Superphosphate Continues. Weakness in Soybean Meal Affects Other Organics. Potash Production Contracted For

NEW YORK, September 27, 1950

Sulphate of Ammonia

This material was moving well against contracts and buyers were taking the material as it becomes available.

Nitrate of Soda

There was no price change in this material and the market was a rather routine affair. Stocks were adequate at various ports

Ammonium Nitrate

In spite of the recent price advance by one of the large producers, demand for this material continues excellent with shipments going forward on contracts.

Nitrogenous Tankage

This material is very scarce and some producers are now sold out until the second quarter of next year. Buyers would easily be willing to pay premium prices if the material was available for nearby shipment.

Castor Pomace

This market was nominal for lack of offerings. Inquiry was heavy from the buyers but producers are forced to hold back offerings until they can secure an adequate supply of castor beans.

Organics

Organic fertilizer materials changed very little the past week and sales were made of tankage and blood at around $8.50 per unit of ammonia ($10.33 per unit N), f.o.b. eastern points, but feed buyers were showing little interest, due to the weakness in soybean meal. Sales of this material for shipment late this year were made as low as $53.00 per ton, f.o.b. Decatur, Ill. Linseed meal for prompt shipment was hard to move, with the result the crushers cut prices on nearby delivery and material containing 32 per cent protein sold at $61,50 per ton, f.o.b. East Coast points in bulk. Cottonseed meal maintained a fairly firm tone in spite of the weakness of the other vegetable meals, on account of the expected short cotton crop.

Fish Meal

With the end of the fishing season in sight on the East Coast, buyers still showed little interest in this material and ground menhaden meal was offered at $130.00 per ton, f.o.b. fish factories but it was thought on a firm bid this could be shaded. Fish factories report poor fishing for the last two weeks, due to recent storms in the Atlantic.

Bone Meal

Most buyers have covered for their nearby needs but the market remains firm. Feed buyers are not as active as about two weeks ago but the demand from this trade is expected to continue good over the balance of the year.

Hoof Meal

The market is nominally quoted at $7.00 per unit of ammonia ($8.51 per unit N), f.o.b. Chicago. Several sales were noted on this basis.

Potash

Shipments were being made against contracts, with the producers sold out on their expected production for the coming season. Few offerings were noted of foreign material.

Superphosphate

While triple superphosphate remains tight for nearby shipment, regular superphosphate was about in balance with demand and no shortages were reported. While several new plants for the manufacture of triple superphosphate have been built recently, the demand still exceeds the supply.

CHARLESTON

Shortage is Nitrogenous Tankage and Triple Super. Box Car Shortage Hampers Some Material Shipments

CHARLESTON, September 25, 1950

Triple superphosphate remains in tight supply, but no serious shortage of other prime fertilizer ingredients has developed. Shortage of box cars is hampering the movement, particularly of potash, with the situation likely to get worse.

Organics.—The major producers of nitrogenous tankage continue sold up for several months ahead. The market for this material is nominally $4.35 to $4.50 per unit of ammonia ($5.29 to $5.47 per unit N), in bulk, f.o.b. production point. Dried ground blood and tankage have eased somewhat in the last week. Offerings of imported nitrogenous tankage are limited and the price around $5.50 to $5.75 per unit of ammonia ($6.68 to $6.99 per unit N), in bags, c.i.f.Atlantic Ports.

Castor Pomace.—The market continues strictly nominal at $32.50 per ton in bags, f.o.b. Northeastern production point, and producers are sold up. Indications are that any new supplies will sell at higher figures.

Dried Ground Blood.—This market is rather quiet at around $9.00 per unit of ammonia ($10.94 per unit N), inb bulk, f.o.b. New York, with the Chicago market $8.50

($10.33 per unit N), in bags, and $8.25 ($10.02 per unit N), in bulk.

Fertilizer Tankage.—Offerings are light and only for January. Forward shipment at around $8.00 per unit of ammonia ($9.72 per unit N), in bulk, f.o.b. Chicago.

Potash.—Box car shortages have complicated the movement, but not to any serious extent, as yet. Expected need for cars to move grain will doubtless curtail somewhat the movement of potash from the West. Demand continues heavy and the market is firm.

Ground Cotton Bur Ash.—Advance estimate of the available supplies for the new season indicates that the quantity will be considerably less than last season. A limited quantity is already under contract, but producers wish to have better indications of available supplies before offering further quantities.

Phosphate Rock.—Movement is seasonal against contracts, and prices continue steady.

Superphosphate.—Normal superphate movement is becoming more active, particularly in the Midwest. Prices continue steady for this grade. Triple superphosphate is short of demand and the market is tight.

Sulphate of Ammonia.—Demand continues active and is steadily absorbing current production. Synthetic production for export movement has been raised in price to $42.00 per ton in bulk at the Gulf Ports.

Ammonium Nitrate.—Canadian material is now priced $5.50 per ton higher, at $63.00 per ton in bags. No change has been noted in the price of domestic material which is at $58.00 per ton, f.o.b. works. Available production is heavily under contract and the market is tight.

Nitrate of Soda.—No unusual activity is noted for this material. Stocks are adequate and demand is seasonal. Price remains unchanged.

CHICAGO

Organics Market Easier. Lower Price Levels Reported but No Drastic Changes Expected

CHICAGO, September 25, 1950

The midwest market on animal ammoniates turned somewhat easier. Buying interest during the past week or ten days has been more or less indifferent and efforts to move material resulted in slightly lower price levels being established. The state of the market does not indicate any improvement for the immediate future and it appears quite possible that a continuing lack of aggressive buying may result in still further declines, although no drastic changes are anticipated.

Ground and sacked meat scraps, 50 per cent protein, are generally listed at $120.00 to $125.00 per ton, but limited buying interest is indicated at $115.00 per ton. Digester tankage in bags, 60 per cent protein, is listed at the same levels as meat scraps and in this case, too, buying interest is at around $115.00 per ton. Dry rendered tankage is in very light demand and while previous business was done at $2.10 per unit of protein, limited sales have been reported at $2.00 and some buyers are now indicating $1.90 per unit. Wet rendered tankage also declined to the extent of about $1.00 per unit of ammonia and is now nominally quoted at $9.00 to $9.50 ($10.94 to $11.55 per unit N). Dried blood is also easier with some trading reported at $8.25 to $8.50 per unit of ammonia ($10.00 to $10.33 per unit N). Steamed bone meal, 65 per cent B.P.L., in bags is quoted at $75.00 to $80.00 per ton and raw bone meal, 4½ per cent ammonia, 45 per cent B.P.L., at $75.00 per ton.

PHILADELPHIA

Market Shows Seasonal Quiet. Demand for Triple Super Continues. Material Supply Generally Adequate

PHILADELPHIA, September 27, 1950

Materials market is rather seasonally quiet with most deliveries moving against contracts. Supplies on the whole appear sufficient to meet all requirements, except possibly notrogenous tankage for which there is brisk inquiry. Organics are firmer, but no price advance.

Sulphate of Ammonia.—Supply continues somewhat tight and just about able to meet contract requirements. The price for converter's grade for export is reported advanced in some areas.

Ammonium Nitrate.—The supply is definitely tight in the face of

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*MAN MADE MOUNTAINS

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active demand. Production is well under contract, and the contemplated advance in Canadian price has taken place. No change is reported in the domestic price.

Nitrate of Soda.—Price remains unchanged and supplies are ample to meet all requirements. Any shortage of domestic due to recent strikes was easily made up by arrivals from Chile. Seasonal demand continues.

Blood-Tankage-Bone. Market for blood and tankage is firm though rather quiet. Price remains at about $8.25 to $8.50 per unit of ammonia ($10.02 to $10.33 per unit N), with bone meal steady at $60.00 to $65.00 per ton, depending on the grade. Hoof meal remains quiet at $7.00 per unit of ammonia ($8.51 per unit N).

Castor Pomace.—There appears to be no market in this material at this time.

Fish Scrap.—Feeding demand is off and market is lower. Supply position is reported easier, with menhaden meal quoted at $130.00 per ton, and scrap at $120.00 to $122.50.

Phosphate Rock.—Shipments continue against standing contracts, and export inquiry presently rather limited.

Superphosphate.—Market remains steady for normal grade and the supply position is tightening somewhat. Triple grade continues short and it seems unlikely that there will be much, if any, easement until well into 1951.

Potash.—Shipments of domestic grade continue to move against contracts, although there is some delay due to car shortage. Production is proceeding at full plant capacity. Interest in foreign potash is rather lax.

The Arab was telling of the time he had lost his way in the desert. Just as he was about to abandon hope and let his hunger overcome him, he found a bag of pearls. "I shall never forget" he said, "the relish and delight I felt thinking the contents of the bag to be dried wheat, nor the bitterness and despair I suffered in discovering that the bag contained nothing but pearls."

Changes in Mathieson Personnel

Changes in the Operating Division of Mathieson Chemical Corporation have been announced by Carl F. Prutton, vice president, director of operations. The transfer of some personnel and the promotion of others are a result of the corporation's several expansion programs.

R. B. Worthy, vice president, formerly general manager of both the Saltville, Va., and Baltimore, Md., operations, will now devote his entire time to the Saltville operations where he will make his headquarters. His new responsibilities include supervision of the construction and operation of the new $6-million electrolytic chlorine plant at Saltville.

Arthur T. Bennett, vice president, formerly general manager of SASCO operations, with headquarters in Houston, has been appointed general manager of the Baltimore operations.

Both the Saltville and Baltimore operations are considered major units for the defense effort.

Mathieson's southwestern plants, formerly operated as a group, have been formed into separate operating divisions as follows:

Joseph Mullen, Jr., has been appointed operating manager of the Little Rock (Arkansas) operations which consist of fertilizer and acid plants. H. T. Galt has been appointed assistant operating manager at Little Rock.

James S. Gilliam has been named operating manager, Sulphur Recovery operations, consisting of sulphur recovery plants at McKamie and Magnolia, Arkansas.

R. T. Braun has been made operating manager of Southwestern Acid Plants operations, consisting of sulphuric acid plants at Port Arthur and Beaumont, Texas, and Bossier City, Louisiana.

W. S. Miller has been appointed operating manager of the Houston (Texas) operations, and John R. Beatty, assistant operating manager. The Houston operations consist of fertilizer and acid plants at Pasadena, a sulphur plant at Houston, and an engineering department for servicing all the southwestern plants.

MINERAL SALTS

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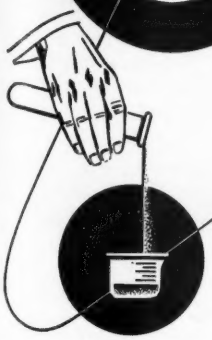

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New Louisiana Fertilizer Plant

Green & Reedy, tung oil producers at Franklinton, Louisiana, are now completing construction of a fertilizer mixing plant. The new building, which measures 260 by 160 feet, is of all-steel construction and will utilize the company's tung meal and tung hull by-products in the preparation of their mixtures. The machinery is being installed by Atlanta Utility Works and material handling will be performed by payloaders of the Frank G. Hough & Co. The company will be operated as Green & Reedy Fertilizer Plant, Franklinton, La.

2, 4-D Aids Corn

Control of broadleaved weeds in Golden Cross Bantam sweet corn has been obtained with a 2, 4-D spray in tests carried on for the past three years on the canning crops farm at the Experiment Station at Geneva,N. Y.

The best results were obtained when a complete cover spray of three-fourths pound of 2, 4-D was applied just as the corn was breaking ground or within a week thereafter. However, sprays made when corn was two feet tall did not seem to reduce yields.

The amine salts of 2, 4-D were effective in controlling mustard, lamb's quarters, red-root, ragweed, and smartweed in sweet corn. The ester forms of 2, 4-D were found to be so volatile that they were regarded as unsafe to use even though sweet corn may be readily weeded with them. The vapors that arise from fields sprayed with the esters of 2, 4-D may drift in air currents to sensitive crops, such as tomatoes, and cause serious losses.

"In fact," say the Station scientists, "it should be emphasized that 2, 4-D is a potent weed killer and careless use of even the amine forms may result in heavy damage to vegetable crops, and fruit trees."

Sweet corn yields were extremely low in areas in the Station tests where annual grasses came in following weeding with 2, 4-D and without subsequent cultivation. Where the broadleaved weeds were killed with 2, 4-D and the sweet corn was cultivated to kill out quack grass and the annual grasses, satisfactory yields were obtained.

August Tag Sales Increase

Combined tag sales and shipment reports from 9 southern and 3 midwestern States for the month of August, as compiled by The National Fertilizer Association, showed a 38½ per cent increase over the corresponding figure for August 1949. Exclusive of North Carolina and Oklahoma, the equivalent fertilizer tonnage covered by tag sales and shipment reports totaled 349,922. Of this amount 163,500 tons (55 per cent more than a year ago) is Midwest.

Cumulative January-July totals show at 3 per cent increase in the South and a 16 per cent rise in the Midwest, from 1949 to 1950; the increase is about 5 per cent.

FERTILIZER TAX TAG SALES AND REPORTED SHIPMENTS
IN EQUIVALENT SHORT TONS)
COMPILED BY THE NATIONAL FERTILIZER ASSOCIATION

	August		*Calendar Year Cumulative January-July*		*Fiscal Year Cumulative July-June*	
State	*1950*	*1949*	*1950*	*1949*	*1949–50*	*1948–49*
Virginia	39,735	36,379	519,782	504,318	700,210	684,893
North Carolina	*	15,795	1,433,033	1,268,777	1,682,365	1,724,824
South Carolina	26,500	13,744	713,335	771,345	905,759	998,512
Georgia	20,105	8,929	963,471	1,022,944	1,173,518	1,276,385
Florida	34,990	42,134	617,445	551,271	1,038,777	863,637
Alabama	13,933	8,270	856,580	903,904	989,812	1,063,216
Tennessee	9,478	5,663	387,762	372,017	473,781	502,304
Arkansas	9,694	4,529	303,571	279,432	357,548	355,585
Louisiana	8,179	7,044	209,127	190,687	260,925	254,566
Texas	23,808	20,210	346,681	302,010	547,179	499,154
Oklahoma	*	10,469	92,132	77,290	142,830	116,260
Total South		173,166	6,442,919	6,243,995	8,272,704	8,339,336
Indiana	71,355	50,820	567,064	491,559	870,908	872,395
Kentucky	45,751	22,031	417,373	342,745	565,454	535,998
Missouri	46,394	32,860	335,370	306,605	460,699	472,163
Total Midwest	163,500	105,711	1,319,807	1,140,909	1,897,061	1,880,556
Grand Total		278,877	7,762,726	7,384,904	10,169,765	10,219,892

*Not available at present.

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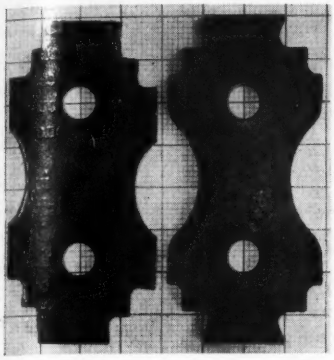
Sedberry Hammer Mill Chart

The J. B. Sedberry Company of Franklin, Tenn. is offering the owners of Jay Bee hammer mills a unique actual size hammer chart for checking accurate hammer size and balance.



The illustration shows a standard Jay Bee hammer on the right, a home made hammer on the left. The Jay Bee chart is actual size so that mill owner may lay an actual hammer over the image on the chart. If the hammer shows up on the chart to be out-of-contour, with hammer support rod holes unevenly located in respect to hammer ends (such as left hand picture) there will be several things possiblywrong with mill performance:

The mill will run "out-of-balance."

If the mill is out-of-balance, it will vibrate excessively which always leads to premature replacement of discs, bearings, pillow blocks and shafts.

In addition to the expensive replacement of mill parts like the above, the mill owner will lose the "down-time" caused by such replacements.

The Hammer Chart, as illustrated, may be obtained free of charge from the J. B. Sedberry Company or any of its distributors.

Guard Against Borer

The Pacific peach tree borer can cause a girdling effect on such fruit and nut trees as the almond, apricot, cherry, prune and plum. Growers at times overlook the damage until too late to save the tree.

According to the University of California Agricultural Extension Service, for several years the recommended control measure has been to sprinkle a continuous ring of paradichlorobenzene (P. D. B.) around the tree during late summer and fall. From three-quarters to 1 ounce of the material per tree is the recommended dosage. This needs to be sprinkled around the tree in a continuous ring about 2 inches wide and some 2 to 4 inches from the base of the tree. The ground around the base of the tree is leveled before applying this fumigant, and the P. D. B. crystals should be covered with earth after the ring is completed. Disadvantages of this method are the labor involved and possible damage to young trees from the treatment. However, it remains the most effective treatment now.

Harold Madsen, extension entomologist of the College of Agriculture, states that tests with benzene hexachloride (B. H. C.) and DDT as trunk sprays have brought about only poor results to date, probably because of the overlapping broods of the borer. New soil fumigants are being tried with this pest this year and more information on these should be available at the end of the season.

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Koppers Ammonium Sulphate comes in crystals with low free-acid and moisture content. The nitrogen content is guaranteed to be not less than 20.5%.

Shipment

Koppers Ammonium Sulphate is shipped in bulk in boxcars and trucks. It is also available in 100 lb. and 200 lb. bags. Shipments are made from: Kearny, N. J. . . . St. Paul, Minn. . . . Granite City, Ill. (St. Louis) . . . Midland, Pa.

International Minerals Reports Record Earnings

The 41st annual report of International Minerals & Chemical Corporation for the fiscal year ended June 30, 1950, recently distributed to stockholders records the largest year in the corporation's history in both sales and earnings, according to Louis Ware, president. This is the fifth consecutive year in which earnings have established new records.

In a letter to stockholders accompanying the report, Mr. Ware pointed out that net income for the fiscal year ended June 30, 1950 was $5,776,660 as compared with $5,421,017 the previous year. Earnings per common share amounted to $6.80 on the 791,870 shares outstanding at June 30, 1950, an increase of 7 per cent over the $6.36 per share reported on the 790,305 shares outstanding June 30, 1949.

The net sales for the year were $58,402,180 an increase of 9 per cent over the sales of $53,394,760 last year and an increase of 17 per cent over sales of $50,123,269 for the year ended June 30, 1948.

Net working capital at June 30, 1950 was $19,676,783 showing an increase of $4,243,465, or 27 per cent during the year. Cash balances were $8,304,004 compared with $6,039,340 a year ago. Receivables are higher than a year ago, reflecting the increased volume of sales.

Expenditures for construction during the year amounted to $2,376,035 representing principally the cost of ordinary replacements and minor additions.

Commenting on the corporation's sales and production activities, Mr. Ware said: "Substantial increases in the sales and production of the Phosphate and Amino Products Divisions more than offset decreases in the sales and production of the Plant Food and Potash Divisions. The sales of potash would have exceeded a year ago except for a work stoppage of seventy-three days caused by a strike. Plant Food Division sales were 3 per cent less than last year in total tons and 7 per cent less in dollars, the additional decrease being the result of lower average sales prices per ton. Phosphate sales and production were the greatest of any year in the corporation's history, chiefly as the result of production increases of high grade phosphate in Florida and record export shipments.

"Animal feeds, pharmaceuticals, refined potassium chloride and other chemicals contributed to the sales and production increase in lesser but growing amounts. Animal feeds, made from our own phosphate, have shown such promise in volume and profits this year, that a new plant has been authorized for their production. This new phosphate chemical plant will produce higher grade phosphate feeds, a new form of higher analysis multiple superphosphate for use in specialty grades of fertilizer, and eventually will manufacture other phosphate chemicals. The plant will use patentable processes developed by our Research Division.

"Plant Food sales and production will be increased in the near future by the erection of an acidulating and mixing plant at Fort Worth, Texas. Production costs will be lowered by the construction of a new sulphuric acid plant at Mason City and by the production of sulphuric acid in Florida at the new phosphate chemicals plant.

"The Phosphate Division has brought additional drying and grinding facilities into production during this year and will still further expand grinding capacity during the coming year. This enlarged capacity is needed to satisfy greater demands for ground phosphate. New shops, offices and laboratories now being built in Florida will increase efficiency and lower costs of production.

"The Potash Division is progressing rapidly with the sinking of a third shaft at the Carlsbad mine. This is a part of the continuing development of the potash ore reserves as mentioned in previous reports.

"Important high grade reserves were acquired at both the Noralyn and Peace Valley phosphate mines in Florida. In Tennessee unmined reserves were augmented by purchase and lease.

"Materials for the Plant Food Division are plentiful. Nitrogen has been reduced in price which should enable us to reduce the costs of manufacture of our fertilizer mixtures. Adequate supplies of phosphate, potash and other ingredients are assured."

Pointing to the future, he said: "The demand for the minerals and chemicals produced by this corporation should continue strong during the coming year. We are convinced that increased application to the selling of our products, the continued improvement in our plant efficiencies, the moderate expansion of our capacity and the earnest application of a good working team to each of our problems should result in a satisfactory rate of operation and profit in the year ahead."

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Caution Emphasized in Arkansas Insecticides

New Developments in the field of insecticides bring about the necessity for more and more caution in their use, Charles Lincoln, Extension entomologist, recently warned Arkansas farmers.

"Insecticides are poisonous to man and to warm blooded animals as well as to insects," the University of Arkansas College of Agriculture specialist pointed out. "They can be used safely, but carelessness and failure to follow directions bring on accidents."

The greatest danger comes in storing insecticides where they can be mixed with food or feed or where children can get to them, he explained. A locked cabinet or box out of reach of children, pets and livestock is the safest place, and insecticides should never be stored in the same room with food or feed.

To avoid toxic or illegal residues when the chemicals are used, Dr. Lincoln strongly urged farmers to follow recommendations on when and where to use certain materials as supplied by the county Extension agent to fit local conditions.

Spraying or dusting should be done carefully and under good atmospheric conditions. He pointed out that cattle are killed every year when calcium arsenate is carelessly dusted onto pastures. Bees also are destroyed in this way. Fish are killed by drifting toxaphene and other organic insecticides. Drifting benzene hexachloride may taint the flavor of near-by fruits and vegetables.

Handling Precautions

Some insecticides can cause poisoning if breathed or absorbed through the skin as well as by being swallowed, Dr. Lincoln cautioned. Persons engaged in applying insecticides should avoid unnecessary exposure to them, and wearing a respirator with a suitable filter is advisable. Hands should be washed thoroughly before eating, he cautioned, adding that at least once a day a person handling and applying insecticides should bathe and change clothes completely.

"Insecticides recommended for Arkansas by the Agricltural Extension Service are safe to use with ordinary precautions," Dr. Lincoln emphasized. Certain insecticides are highly toxic and are not recommended for farm use in Arkansas, he cautioned further. Hydrocyanic acid and other cyanides are recommended only in the hands of professional operators. The new phosphorus compounds, such as Parathion, TEPP (tetra-ethyl pyrophosphate) and HETP (hexaethyl tetraphosphate), are extremely poisonous materials. Parathion killed several farmers last year. *These insecticides are not recommended in Arkansas because of the hazard in their use.*

Aldrin (118) and Dieldrin (497) are promising new insecticides, Dr. Lincoln asserted, but they are very toxic to animals and extremely hazardous to handle. They should be handled similarly to parathion until the hazards in connection with their use are better understood.

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Soil Scientist Believes 100 Bushel Corn Practical

How would you like to harvest 100 bushels of corn per acre on the average. Sound impossible? C. M. Woodruff of the soils department at Missouri University believes not. In fact, he says it may be possible to push those yields up to 150 bushels per acre during some of the best years. Other years, the yield may drop considerably below the 100-bushel mark because water shortage may be the limiting factor.

There's no secret to these high corn yields, says Woodruff. The key is a relatively cheap source of nitrogen. In the past, crop yields have been limited to the amount of nitrogen supplied through legume fixation. But legumes do not have the capacity to fix nitrogen for record yields. Woodruff believes that the best anyone could expect from that system is 50 bushels.

Woodruff has been working with the idea of 100-bushel an acre corn crops since 1946. On the soils and crops experimental fields at Columbia, more than 100 bushels of corn per acre have been harvested for the past three years.

Former ammunition plants are now fixing synthetic nitrogen. And it is easy to get nitrogen to do the job. However, Woodruff says the future looks even brighter. Indications are that anhydrous ammonia will supply nitrogen to the soil cheaper than other forms of nitrogen carriers.

Experimental results at Sanborn Field at Columbia show that two pounds of nitrogen are required to grow a bushel of corn—one pound to grow the stalks and one pound to grow the ears. Therefore, Woodruff says that 200 pounds of nitrogen must be available to the plants for 100-bushel-an-acre corn yields.

But in order to use this available nitrogen, phosphorus and potassium levels must be sufficiently high. Soil tests from county laboratories will enable Missouri farmers to use nitrogen and other fertilizers most efficiently.

Texas Battles Bugs

NEVER in the history of the war against insects have as many people been so well equipped with good insecticides and the machinery with which to apply them as at the present time. Texas cotton farmers alone used 50 million pounds of insecticides in 1949. In all experimental and result demonstration work over the state the average gain of the control plots over the untreated portion was a third of the total cotton produced. Cotton insect control measures were followed on 4.3 million acres and it is estimated that cotton farmers made a net profit of $27.17 per acre through insect control, or a total of $117 million for the entire state.

Over 1.5 million pounds of insectidicdes were used on livestock for control of external parasites in 1949—an increase of 37 per cent over 1948. Almost 4 million head of livestock were treated and it is estimated that stockmen made an additional profit of $9.5 million in this way.

The old dipping vat is on the way out; 1,343 vats were abandoned during the past year, while 3,432 power sprayers were bought in 1949. Little more than a thousand gallons of arsenic dip—once the standard—were bought in Texas in 1949, which is a measure of the confidence livestock producers have in the new organic insecticides.

IN 1949

No. demonstrations on animal parasite control	9,966
No. cotton growers following recommended insect control	70,474
No. acres treated	4,265,439
No. growers following recommended vegetable insect control	148,787
No. growers following recommended fruit insect control	17,131

Fly and mosquito control measures were reported from 117,596 farms and ranches in 1949—an increase of some 75 per cent over the 1949 totals.

The Extension Service was able to give additional aid to farmers and ranchmen in 1949 through the appointment of two associate county agents specializing in entomology. One of these men was assigned to work in Cameron, Willacy and Hidalgo counties, the other to the Lubbock area. This in turn released the Extension Service specialists for more concentrated work in other counties, and they were able to assist in 576 meetings.

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Potassium Content of Oklahoma Soils

Oklahoma soils, generally speaking, are less likely to be low in potash than in either phosphorus or lime; but 11 counties, mostly in the southeast central area, show upward of 30 per cent of samples low enough in potassium to suggest the need of potash fertilizer. Results of potash analyses of 6,379 soil samples, representing all 77 counties, are given in Station Bul. B-346, recently published.

Gold in Massachusetts Pastures

There's gold in the pasture feed of New England farms and the best way to "mine" it is through better management, says Ralph W. Donaldson, extension agronomist at the University of Massachusetts. The Bay State Green Pasture program is now in full swing, he points out, with 903 farmers enrolled at the latest count.

"As proof of what I mean, let me tell you about two farms I visited last week," Donaldson relates. "Farmer A had just finished paying out $800 for his hay He said he never used fertilizer except a little government superphosphate. 'Couldn't afford it,' was his comment.

"Another farmer nearby sold 45 tons of extra hay produced on his farm. This was sold at $30 a ton. That $1350 was enough to buy 20 tons of 7-7-7 fertilizer.

"Farmer A has a herd of mixed animals. Farmer B has a herd of Jerseys. A's herd is much larger than B's, yet Farmer B's herd is producing twice the milk."

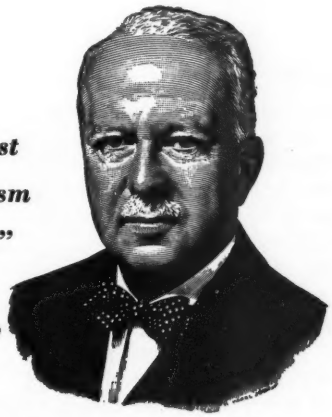
Says Donaldson, do you need any better proof that green pastures will produce gold? Good cows and good feed make the right combination.

As insurance for plenty of pasture right through the summer, dairymen should sow sudan grass and millet in late June for extra feed in August. Also re-fertilize hay land after early cuttings, advises Donaldson. This makes for a heavier summer growth which can be used for rowen or pasture.

Carbon Black and Soil

A method of extending the crop-growing season by mixing carbon black with soil has been tested at the Massachusetts State College Experimental Station at Amherst. The carbon black was mixed with the soil to a depth of two inches, which resulted in a rise in temperature both at the surface and two inches below. This is explained by the fact that black materials absorb heat. If it is economically practical to use the method, it is believed farmers who specialize in garden produce will be able to de-frost their land and start planting earlier in the spring. In the experiments carbon black was applied at the rate of two tons to the acre, although one ton per acre was found effective. The tests involved taking temperatures every 15 minutes 24 hours a day for more than a year. In spring and summer the maximum daily temperatures reached by carbon-black-treated soil surfaces averaged two degrees higher than the maximum temperatures of untreated soil surfaces. At a two-inch depth carbon-black-treated soil showed maximum daily temperatures 3.4 degrees higher than those of untreated soil. The experiments gave no indication that carbon black acts as a plant nutrient or is itself digested by plant roots. Nor was it believed to have any other direct effect on plants. Its influence is attributed entirely to its effects on soil temperatures, texture, and moisture-retention properties.

"The immunizer against the disease of communism is a certain feeling . . ."



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Rate For Superphosphate

The recommended rates of application for superphosphate are 30 to 40 pounds of available phosphate per acre for sweet clover and twice this amount for red clover, according to University of Nebraska extension soils specialists.

Dr. M. D. Weldon says superphosphate is most effective if drilled in with oats—when the nurse crop and clover are planted together. But he says the fertilizer also may be broadcast and disked in before seeding.

Nitrogen fertilizer, he says, should be broadcast when the oats or barley is two to six inches high at a rate to supply 20 to 40 pounds of available nitrogen per acre. He cautions heavier applications may cause lodging of the grain crop which also would injure the clover.

High Corn Yields

Where topsoil was eight inches deep at the Southern Piedmont Experiment Station, Watkinsville, Georgia, hybrid corn produced an average of 65 bushels per acre during a three-year period.

S. R. Doughty, Auburn Extension Service Soil conservationist, points to the corresponding yields which were 52 bushels per acre annually for five inches of topsoil and 38 bushels for two inches of topsoil. For the prior 1943–46 four year period, corresponding averages for open-pollinated corn then being grown in the same rotation were 32, 24, and 18 bushels per acre.

"Every inch of topsoil lost reduced the yield of corn," emphasizes Doughty. "The effects on yields proved to be more serious after the first half of the topsoil was lost. Also, the yield of oats was seriously affected by the loss of each inch of topsoil after the top half had been eroded away."

Fertilizing Sugar Beets

The soils specialists at Michigan State College say that with sugar beets, just as any other crop, it would be false economy not to use fertilizer, but it isn't going to give you high yields unless you combine it with good practices. As Paul Rood, extension specialist in soils, points out, higher yields of sugar beets are the result of good tillage and soil management, alfalfa or sweet clover in the rotation, a good stand of beets, and generous use of commercial fertilizer not only on the beets but also on other crops in the rotation—especially grains.

As to amounts, the college people and the beet growers' association have recommended the use of fertilizer on beets at two rates—200 pounds per acre and 500 pounds per acre. The yields of beets have averaged 1.7 tons per acre higher where 500 pounds was used, showing that the higher rate is well worth the money. The 4-16-8 analysis containing five per cent manganese and half that much borax is recommended.

Granule Size vs. Crop Response

(Continued from page 12)

without introduction of phosphorus fertilizer.

"Because of the much greater growth of the root system, the activity of the microorganisms in the rhizosphere becomes very extensive. The better growth of the root system produced by the phosphorus results in the enrichment of the soil with organic substances and, hence, in the improvement of its physical properties. Subsequently, during the decomposition of the organic substance, microbiological processes also develop differently.

"Accordingly, the indirect effect of fertilizers on the soil and the microflora not only benefits the plant for which the fertilizer was introduced but also produces residual effects."

SUMMARY

"1. When powdered superphosphate is broadcast, the plants utilize merely a negligible portion of the phosphoric acid, whereas the major portion is sorbed by the soil. Broadcasting of powdered superphosphate produces the largest contact of the fertilizer with the soil and thus promotes to a maximum degree the conversion of the readily soluble superphosphate to a sparingly soluble form. The result is that the major portion of superphosphate is used for 'fertilizing the soil' and not for providing nutrition to the plants.

"2. Granulated superphosphate increases to an unprecedented degree the utilization of the phosphoric acid in the fertilizer and produces favorable conditions for a better utilization by the plant of phosphorus and other nutrients in the soil.

"3. The customary calculation of the 'coefficient of utilization' by difference of the uptake of nutrients in fertilized and control plots is a purely mechanistic method.

"4. It is inadvisable to drill large amounts of superphosphate. The variation from 8 to 40 kg. of P_2O_5 per hectare (36 lbs. per acre) in the present tests did not affect the yield, whereas utilization of the phosphoric acid decreased as the amount of drilled fertilizer increased.

"5. It is advisable to manufacture superphosphate in a form and to apply it by methods that decrease to a minimum the contact of the fertilizer with the soil and produce the best conditions for its utilization by plants and the useful microflora.

"For this purpose it is essential to manufacture granulated superphosphate and to apply localized introduction (spots, granules of various sizes, drills, ribbons, etc.) on a large scale."

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Distribution Needs

(*Continued from page 7*)

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Almost every time the subject of public relations comes up, somebody says, "That's all very well. But you are a big company; you can afford to do these things: but I run a small company, or I am a small business man, or I am only a plain citizen."

Community Level

Now the truth is, and we all know this as a matter of business but we sometimes forget it as a matter of public relations, that you can have a business on a national level, but it is built and maintained on a community level. We can create and set in motion a whole enormous system, national advertising campaigns, sales promotion, and all the rest for the sole purpose of getting one man or one woman at a time to sign an order for one range or one refrigerator. But you can't keep it "sold" unless you have a representative in that community who understands the problems of the customer and who can provide the service he needs.

Everything we have learned about public and community relations teaches the absolute necessity of breaking down the operation into the smallest possible segments, of trying to reach every man, on his own level, in the community in which he lives.

Manufacturers and distributors are partners in business—in a partnership that cuts across artificial distinctions in size and natural geographical barriers.

A. C. S. Fertilizer Abstracts

(*Continued from page 10*)

the benefit of calcium in fruit filling. Furthermore, calcium must be placed in the zone of fruit development as contrasted to the rooting zone. It is absorbed directly through the developing fruit. The most critical period in fruit development in so far as calcium supply is concerned is 15 to 35 days after gynophores (pegs) reach the soil. Calcium sulphate supplied to one side of the plant does not improve the quality of fruit on the opposite side of the same plant.

Relationships between calcium and potassium are discussed. A solution of calium sulphate containing as little as 20 ppm. Ca will prevent the detrimental influence of potassium in fruit filling.

Comparisons of source of calcium in field studies reveal the effectiveness of calcium sulphate as an annual application. When applied at rates between 400 and 600 pounds per acre it is found that response from added calcium sulphate is closely related to degree of calcium saturation and exchangeable calcium, in the soil. The nature of the soil colloid is also an important factor, in general larger quantities of calcium being necessary as the proportion of organic and 2:1 clay increase.

Fluorine Content of Red Clover After Applications of Hydrofluoric Acid on Two Soils

W. H. MacIntire, S. H. Winterberg, L. B. Clements, L. J. Hardin and L. S. Jones, University of Tennessee Agricultural Experiment Station, Knoxville, Tenn.

An experiment was set up to simulate the effects from atmosphere-derived hydrofluoric acid on two soils, unlimed and limestoned, and upon the fluorine content of red clover in pot cultures, so that such content would be attributable solely to movement of fluorides from soil to crop. Constant-volume sprinklings supplied HF at rates of 100, 400, and 800 pounds of fluorine per acre surface. Six days later each upper two inches of soil of the 8-inch depth was mixed and clover was seeded to the Hartsells and Clarksville soils. The 100-pound increments registered small effect upon clover response and fluorine content and upon soil pH. The 400-pound applications caused decided decrease in the growth of clover and increased its content of fluorine on the unlimed soils, but repressions in growth and increases in fluorine content were not so appreciable on the limestoned soils. The 800-pound applications virtually inhibited growth of clover on the unlimed soils, affected it significantly on the limestoned soils and imparted substantial enhancements in fluorine content. All applications of HF caused lowering of pH, except in those series where the incorporations of limestone were augmented to offset the acid in the upper 2-inch zone.

The findings do not establish toxicity for the fluoric ion. That factor and persistence of the detrimental effects of the heavy applications of HF, in parallel with equivalent applications of HCl, are objectives of an amplification of the exploratory study.

The findings support earlier conclusions that a soil adequately supplied with calcium can absorb a substantial quantity of fluoric effluents without significant effects upon yield and fluorine content of forage crops.

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